

WEST[Help](#)[Logout](#)[Interrupt](#)[Main Menu](#)[Search Form](#)[Posting Counts](#)[Show S Numbers](#)[Edit S Numbers](#)[Preferences](#)**Search Results -**

Terms	Documents
17 and 11	0

Database:

US Patents Full-Text Database ▲

JPO Abstracts Database

EPO Abstracts Database

Derwent World Patents Index

IBM Technical Disclosure Bulletins ▼

Refine Search:

17 and 11 ▲▼

[Clear](#)**Search History****Today's Date: 12/17/2000**

<u>DB Name</u>	<u>Query</u>	<u>Hit Count</u>	<u>Set Name</u>
USPT	17 and 11	0	<u>L10</u>
USPT	17 and ((149/\$)!.CCLS.)	7	<u>L9</u>
USPT	17 ((and149/\$)!.CCLS.)	227	<u>L8</u>
USPT	13 same 15	227	<u>L7</u>
USPT	14 and 15	32	<u>L6</u>
USPT	(metal or aluminum) adj powder	19924	<u>L5</u>
USPT	13 and ((149/\$)!.CCLS.)	132	<u>L4</u>
USPT	agglomerate	23000	<u>L3</u>
USPT	11 and agglomerate	0	<u>L2</u>
USPT	((102/202.\$)!.CCLS.)	1197	<u>L1</u>

WEST

Generate Collection

L9: Entry 1 of 7

File: USPT

Nov 28, 1989

DOCUMENT-IDENTIFIER: US 4882994 A

TITLE: Particulate fuel components for solid propellant systems

BSPR:

In U.S. Pat. No. 4,256,521, metal powders of nodular, flaky, irregular or acicular shape are granulated with a synthetic resin binder to build up a porous agglomerate having a size range of 100 to 2,500 microns having an apparent density of between 0.4 and 1.1. The porous metal powder agglomerates are formed by conventional granulating means which subject the metal powder and resin binder feed to a rolling or mixing motion or both. In U.S. Pat. No. 4,452,145, thermoplastically deformable elastomers are deposited on particles of the oxidant from a solution containing the elastomer.

CCXR:

149/109.6

CCXR:

149/19.9

CCXR:

149/19.92

WEST

Generate Collection

L9: Entry 2 of 7

File: USPT

Sep 7, 1982

DOCUMENT-IDENTIFIER: US 4348242 A

TITLE: Aluminum powder blasting slurry sensitizer

DEPR:

Preferably, not less than 0.25% of polyvinylpyrrolidone, based on the weight of aluminum present, is used because even though an adequate sensitizer can be obtained at a level as low as about 0.1%, at levels below 0.25% there is some tendency for the aluminum powder particles to agglomerate or weld together during the grinding. Also, at levels of about 0.1% a tendency to form free dust in the filter cake becomes apparent which is highly undesirable as this dust presents an explosion hazard. A level of about 1%, that is in the range 0.5% to 1.5%, is preferred, since at this level optimum properties appear to be obtained.

CCOR:

149/7

CCXR:

149/114

CCXR:

149/6

WEST

Generate Collection

L9: Entry 3 of 7

File: USPT

Mar 17, 1981

DOCUMENT-IDENTIFIER: US 4256521 A

TITLE: Porous metal agglomerates

BSPR:

According to this invention there is provided porous metal fuel agglomerates comprising a combustible metal powder of a size range of 0 to 500 microns, or any cut thereof, granulated with a binder of synthetic resin material by build-up to a porous agglomerate with a size range of 100 to 2500 microns having an apparent density between 0,4 to 1,1.

CLPR:

1. Free flowing substantially dust free porous metal fuel agglomerates comprising combustible metal powder of a size range of 0 to 500 microns, or any cut thereof, granulated with a blender of synthetic resin material by build-up to a porous agglomerate with a size range of 100 to 2500 microns having an apparent density between 0,4 to 1,1.

CCOR:

149/6

CCXR:

149/114

WEST

Generate Collection

L9: Entry 4 of 7

File: USPT

Dec 9, 1980

DOCUMENT-IDENTIFIER: US 4237787 A

TITLE: Incendiary projectile

ABPL:

An incendiary projectile, particularly an armor-piercing projectile, including an incendiary composition constituted of a metal powder admixture as a reducing agent and an inorganic oxidizing agent; and a binding agent for converting these components into a solid form. The oxidizing agent is a nitrate or peroxide of the elements selected from the group consisting of potassium, strontium or barium, the oxidizing and reduction agents being present in about equal parts in the incendiary composition. Binding agents are included in the admixture in a predetermined amount so as to formulate the admixture into a hard-grained agglomerate and to produce a resultant increased impact sensitivity of the incendiary composition.

CLPR:

1. In an incendiary projectile, particularly an armor-piercing projectile, including an incendiary composition constituted of a metal powder admixture as a reducing agent and an inorganic oxidizing agent; and a binding agent for converting these components into a solid form, the improvement comprising: the incendiary composition providing for increased sensitivity to impact to spontaneously ignite upon impact against a target without requiring a separate ignition charge, said oxidizing agent being nitrate or peroxide of the elements selected from the group consisting of potassium, strontium or barium, said oxidizing and reduction agents being present in about equal parts in said incendiary composition; and binding agents being included in said admixture in an amount of 1 to 5% by weight so as to formulate said admixture into a hard-grained agglomerate and with a resultant increased impact sensitivity of said incendiary composition.

CCXR:

149/44

WEST

Generate Collection

L9: Entry 6 of 7

File: USPT

Apr 12, 1977

DOCUMENT-IDENTIFIER: US 4017342 A

TITLE: Method for improving metal combustion in solid rocket propellants

DEPR:

The specially-treated aluminum powder, found to dramatically improve combustion characteristics in solid propellant formulations, has a demonstrated ability to increase propellant burn rate in many AP/HTPB systems. Especially when the burn rate is already low, where large agglomerates are present, agglomerate residence time is short.

DEPR:

The power of this invention and its untreated counterpart were studied on a hot stage microscope to determine whether any differences in behavior would exist, specifically with regard to agglomeration. The sample were heated at a rate of 250.degree. C per minute to a maximum temperature of 800.degree. C and under a flowing argon atmosphere so that the formation of oxide shells would be minimized and agglomeration (if there were to be any) would be enhanced. it was found by S. E. C. examination of 6 micron sized powders that extensive agglomeration took place in the untreated powder while little or no agglomeration could be observed in the powder sample of the invention. The same trend was found in some 27 micron aluminum powder although some agglomeration is present even in the samples of the invention. It should be noted that the agglomerates do become smaller as the conversion level of the invention is increased.

CCOR:

149/5

WEST**End of Result Set****Generate Collection**

L9: Entry 7 of 7

File: USPT

Oct 19, 1976

DOCUMENT-IDENTIFIER: US 3986909 A

TITLE: Boron-fuel-rich propellant compositions

BSPR:

Minor amounts of other metals such as Al, Mg, or Zr can be used in the air-augment propellant to improve ignition efficiency and, therefore, combustion efficiency in the afterburner. Since they ignite more readily than boron, their combustion in the afterburner rapidly raises the temperature to a level at which the boron more readily ignites. As indicated in Table III supra and in Table IV, such metal powders can be incorporated into the propellant fuel binder and/or into the boron-agglomerate particles. It should be noted that when the metal is added to the binder, it tends to reduce pressure exponent somewhat as compared with the formulation without the added metal. Addition to the boron-agglomerate tends to depress pressure exponent even more.

CCOR:

149/19.9

CCXR:

149/113

CCXR:

149/114

CCXR:

149/20

CCXR:

149/22

CCXR:

149/5

WEST[Help](#)[Logout](#)[Interrupt](#)[Main Menu](#)[Search Form](#)[Posting Counts](#)[Show S Numbers](#)[Edit S Numbers](#)[Preferences](#)**Search Results -**

Terms	Documents
15 and 11 and perchlorate	19

Database:

- US Patents Full-Text Database ▲
- JPO Abstracts Database
- EPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins ▼

Refine Search:

15 and 11 and perchlorate

[Clear](#)**Search History****Today's Date: 12/17/2000**

<u>DB Name</u>	<u>Query</u>	<u>Hit Count</u>	<u>Set Name</u>
USPT	15 and 11 and perchlorate	19	<u>L11</u>
USPT	17 and 11	0	<u>L10</u>
USPT	17 and ((149/\$)!.CCLS.)	7	<u>L9</u>
USPT	17 ((and149/\$)!.CCLS.)	227	<u>L8</u>
USPT	13 same 15	227	<u>L7</u>
USPT	14 and 15	32	<u>L6</u>
USPT	(metal or aluminum) adj powder	19924	<u>L5</u>
USPT	13 and ((149/\$)!.CCLS.)	132	<u>L4</u>
USPT	agglomerate	23000	<u>L3</u>
USPT	11 and agglomerate	0	<u>L2</u>
USPT	((102/202.\$)!.CCLS.)	1197	<u>L1</u>

WEST

Generate Collection

L11: Entry 1 of 19

File: USPT

Aug 31, 1999

DOCUMENT-IDENTIFIER: US 5945627 A

TITLE: Detonators comprising a high energy pyrotechnic

BSPR:

Preferred oxidizers are selected from the group consisting of alkali and alkaline earth metal nitrates, chlorates, perchlorates, peroxides and permanganates, ammonium nitrate, ammonium chlorates, ammonium perchlorate and mixtures thereof. It is particularly preferred that the oxidizer salt is a perchlorate or permanganate, and most preferably ammonium perchlorate, potassium perchlorate or potassium permanganate.

BSPR:

A preferred formulation according to the present invention for use in both surface or in-hole detonators comprises a mixture of 70 to 90% of ammonium perchlorate having a median particle size of between 10 and 60 microns, and 10 to 30% of atomized aluminum powder with a median particle size of between 1 to 20 microns.

DEPR:

With reference to FIG. 2a, a non-electric surface detonator is shown in accordance with the present invention. In FIG. 2a, a tubular metal shell 30 closed at its bottom end is shown containing a charge of 300 mg of a high energy pyrotechnic 34 (a mixture of 80% ammonium perchlorate (20 to 40 microns) and 20% atomized aluminum having a median particle size of 5.5 microns) which acts as an initiation portion in the present embodiment. Above initiation portion 34 is delay train 35 contained within a metal tube or carrier 36. Delay train 35 consists of a mixture of red lead, silicon and barium sulphate. Above delay train 35 is the end of a length of inserted shock tube 38 which rests against an isolation cup 37. Shock tube 38 is held centrally and securely in tube 30 by means of closure plug 39 and crimp 40.

DEPR:

In FIG. 3, an electric in-hole detonator according to the present invention is shown. At the closed end of tube 30 is a copper cup 40 which contains a PETN base charge 31 and an initiation portion 32 which is a high energy pyrotechnic consisting of 20% atomized aluminum and 80% ammonium perchlorate. Above cup 40 is a delay train 35 held within a metal tube 36. Above delay train 35 is an electric match head 46 which is connected to a pair of electrically conducting leads 47. Leads 47 pass through a rubber insert 48 which insert is crimped into place by crimps 49 in shell 30.

DEPR:

A mixture of 75% ammonium perchlorate and 25% of an iron oxide coated aluminum flake with a median particle size of 15 microns (available from BASF as "Aluminum Gold", grade L2020 containing approximately 35% iron oxide) was prepared, and used for testing of a series of surface detonators. A variety of particle sizes were compared for the ammonium perchlorate (AP).

DEPR:

Using a ammonium perchlorate particle size of 25 to 40 microns, and a variety of fuels, a series of surface detonators were prepared and tested. The level of the fuels was also varied.

DEPR:

The effect of loading density (i.e. the pressure at which the initiation portion was pressed into the detonator shell) was also studied. In a standard formulation

WEST

Generate Collection

L11: Entry 2 of 19

File: USPT

Dec 8, 1998

DOCUMENT-IDENTIFIER: US 5847310 A

TITLE: Squib for an air bag with an auto ignition composition

BSPR:

Further, Japanese Patent Laid Open No. 5-229397 discloses a technique relating to another auto ignition device. This auto ignition device applies a spontaneous firing agent to an explosive within a squib. The spontaneous firing agent contains sulfur-containing binder/sodium perchlorate as a major component that fires spontaneously in 3 minutes at 150.degree.-300.degree. C.

BSPR:

A conventional squib has a structure in which an explosive is filled within a squib cup of a cylindrical shape with a bottom, which cup is sealed with a squib plug having a bridge wire for heating which is connected to the exterior through a couple of lead pins and the explosive contacts with the bridge wire. The explosive within the squib commonly contains mixtures of perchlorate and an organic material or metal powder, considering the dual requirements of good initiatability and stability. When heated suddenly from outside, lead trinitroresorcinate/potassium perchlorate, for example, will fire spontaneously at about 270.degree. C. while zirconium/potassium perchlorate will fire spontaneously at about 350.degree. C. As other explosives which can be used in the squib, U.S. Pat. No. 3,773,351 discloses those containing sucrose and potassium chlorate.

DEPR:

The oxohalogenates used may be chlorates and perchlorates, such as potassium chlorate, potassium perchlorate, sodium chlorate, sodium perchlorate, barium chlorate and barium perchlorate; bromates and perbromates such as potassium bromate, potassium perbromate, sodium bromate and sodium perbromate; and iodates and periodates such as potassium iodate, potassium periodate, sodium iodate and sodium periodate. Chlorates and perchlorates are particularly preferable in view of easy handling. Potassium chlorate and potassium perchlorate are most preferable. However, any one of these oxohalogenate or mixtures thereof may be used.

DEPR:

The metal powder may be any one of or a combination of zirconium, tungsten, titanium, aluminum, magnesium, iron, nickel and copper. In view of good initiatability, zirconium or a mixture of zirconium and tungsten is preferable.

DEPR:

The squib was assembled in a following manner. A squib sheath 9 was placed in the squib cup 6 as shown in FIG. 3, in which 40 mg of the spontaneous firing explosive composition 5 was added. Subsequently, 120 mg of the initiating agents 4 (zirconium/potassium perchlorate) were placed and a squib sealing plug 1 was engaged therewith. For comparison, a explosive of sucrose/potassium chlorate with no magnesium oxide added. In addition, a squib was assembled in the same manner as those described above. Histories of the squibs were following three of types: the room temperature only, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. The results are given in Table 1. For comparative examples, the explosives were non-initiating in both 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. On the contrary, no change in pressure was found for those according to the present invention.

DEPR:

This spontaneous firing explosive composition was placed in a mill of which

diameter is 10 mm and press-molded under a load of 500 kilo-gram. And then pellets of the gas generant were obtained. Its weight of one pellet is approximately 0.6 gram. As shown in FIG. 7, the above mentioned pellets 30 gram were placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the igniting agents container 40 having the igniting agents (boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 4 and Table 6. Differences in temperature histories during the 60-liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found. An igniting time "t" in Table 4 is a time interval from time when electrical current has finished flowing through the squib to time of starting raising the pressure.

DEPR:

For comparison with the above mentioned examples, the gas generant was made of a sucrose/potassium chlorate without adding magnesium oxide. As in the above, the gas generant without magnesium oxide was placed in a mill of which the diameter is 10 mm and press-molded under a load of 500 kilo-gram. And then pellets of the gas generant were obtained. Its weight of one pellet is approximately 0.6 gram. As shown in FIG. 7, the above mentioned pellets 30 gram were placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 mille-gram, the igniting agents container 40 having the igniting agents (boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 5 and Table 6. During the 60-liter tank pressure-time test, no gas generant was ignited with the temperature histories of 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. During the bonfire test, gas generation were made abnormally with the temperature histories of 120.degree. C..times.100 hours and 107.degree. C..times.400 hours.

DEPR:

An spontaneous firing explosive composition was prepared as follows. 23.0 parts of wood powder having an average particle diameter of 0.05 mm was added to and mixed with 1.0 parts of said light magnesium oxide(reagent; Wako Pure Chemical Industries Co., Ltd.), to which 76.0 parts of potassium chlorate/magnesium oxide mixture prepared in said examples was added and mixed with each other. 24.0 parts of the above mentioned wood powder/potassium chlorate/magnesium oxide composition was mixed with 76.0 parts of spontaneous firing explosive composition based on sucrose/potassium chlorate/magnesium oxide prepared in said examples to obtain gas generant in the form of powder. As shown in FIG. 8, the above mentioned gas generant 30 gram was placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium perchlorate 120 milli-gram, the igniting agent container 40 having the igniting agent (boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60 liter tank and a heating test with firewood (bonfire test). The results are given in Table 7 and Table 9. Differences in temperature histories during the 60-liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found.

DEPR:

The gas generant was made of a wood powder/sucrose/potassium chlorate mixture without adding magnesium oxide by the same manner in the above mentioned examples 22 to 30. As shown in FIG. 8, the above mentioned gas generant 30 gram was placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium perchlorate 120 milli-gram, the igniting agents container 40 having the igniting agents(boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 8 and Table 9. During the 60-liter tank pressure-time test, no gas generant was ignited with the temperature histories of 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. During the bonfire test, gas generation were made abnormally with the temperature histories of 120.degree. C..times.100 hours and 107.degree. C..times.400 hours.

DEPR:

As shown in FIG. 9, the above mentioned explosive composition 1.0 gram was placed in the igniting agents container 40 and sealed. Twelve containers such as the above mentioned igniting agents containers 40 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the gas generant container 50 having the gas generant 55 gram of based on sodium azide, and the igniting agents container 40 having the above mentioned spontaneous firing explosive composition. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 10 and Table 12. Differences in temperature histories during the 60 liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found. An igniting time t in Table 10 and Table 11 means a time interval from time when electrical current has finished flowing through the squib to time of starting raising the pressure. A heating time t in Table 12 means a time for the gas generator 60 to fire. Maximum pressure time means a time for pressure to become maximum.

DEPR:

The squib was assembled in a following manner. A squib sheath 9 was placed in the squib cup 6, in which the spontaneous firing explosive composition 60 milli-gram was added. Subsequently, the initiating agents 4 (zirconium/potassium Perchlorate) 140 milli-gram was placed and a squib sealing plug 1 was engaged therewith. For comparison, an explosive made of sucrose/potassium chlorate/magnesium oxide with no synthetic resins. In addition, the squib was assembled in the same manner as those described above. Histories of the squib temperature were following three types: the room temperature only, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. The results are given in Table 14. there were significant struggling on comparative examples of both 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. On the contrary, those according to the present invention provided stable results in the initiating time as well as the generated pressure.

DEPR:

This spontaneous firing explosive composition was placed in a mill of which diameter is 10 mm and press-molded under a load of 500 kilo-gram to obtain pellets of the gas generant. Weight of one pellet is approximately 0.6 gram. As shown in FIG. 7, the above mentioned pellets 35 gram were placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the igniting agent container 40 having the igniting agent (boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a

pressure-time with a 60 liter tank and a heating test with firewood (bonfire test). The results are given in Table 17 and Table 19. Differences in temperature histories during the 60-liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found. An igniting time t (msec.) means a time up to start raising the pressure after an electrical current has finished flowing through the squib. Maximum pressure time means a time for pressure to become maximum. A heating time t in Table 12 means a time for the gas generator 60 to fire.

DEPR:

For comparison with the above mentioned examples, a gas generant was prepared without granulating with a silicon resin. As in the above, this was placed in a mill of which diameter is 10 mm and press-molded under a load of 500 kilo-gram to obtain pellets of the gas generant. Weight of one pellet is approximately 0.6 gram. As shown in FIG. 7, the above mentioned pellets 35 gram were placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the igniting agents container 40 having the igniting agents(boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a beating test with firewood (bonfire test). The results are given in Table 18 and Table 19. During the 60-liter tank pressure-time test, there were a significant struggling in results. During the bonfire test, filter breakage was caused.

DEPR:

A spontaneous firing explosive composition was prepared as follows. 23.0 parts of wood powder having an average particle diameter of 0.05 mm was added to and mixed with 1.0 parts of said light magnesium oxide (reagent; Wako Pure Chemical Industries Co., Ltd.), to which 76.0 parts of potassium chlorate/magnesium oxide mixture prepared in said examples was added and mixed with each other, to which 5.0 parts of silicon resin was added. The mixture was kneaded over 30 minutes. Thereafter, the mixture was stood at a room temperature over 48 hours to cure the silicon resin. 24.0 parts of the above mentioned wood powder/potassium chlorate/magnesium oxide/silicon resin composition was mixed with 76.0 parts of spontaneous firing explosive composition based on sucrose/potassium chlorate/magnesium oxide/silicon resin prepared in said examples to obtain gas generant powder. As shown in FIG. 8, the above mentioned gas gerierarit 35 gram was placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the igniting agents container 40 having the igniting agents(boron/potassium nitrate) 1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 20 and Table 22. Differences in temperature histories during the 60-liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found.

DEPR:

A wood powder/sucrose/potassium chlorate/magnesium oxide mixture was prepared as a gas generant in the same manner and same ratio of the above mentioned examples 22 to 30 without silicon resin. As shown in FIG. 8, the above mentioned gas generant 35 gram was placed in the gas generant container 50 and sealed as shown in FIG. 6. Twelve containers such as the above mentioned generant containers 50 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree. C..times.100 hours and 107.degree. C..times.400 hours. We used four containers to each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the igniting agents container 40 having the igniting agents(boron/potassium nitrate)

1.0 gram and the above mentioned gas generant container 50. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 21 and Table 22. During the 60-liter tank pressure-time test, there were a significant struggling in results. During the bonfire test, filter breakage was caused.

DEPR:

As shown in FIG. 9, the above mentioned spontaneous firing explosive composition 2.0 gram was placed in the igniting agents container 40 and sealed. Twelve containers such as the above mentioned igniting agents containers 40 were ready. We applied three types of temperature histories. Here are: room temperature, 120.degree..times.100 hours and 107.degree. C..times.400 hours. We used four containers to said each types. Thereafter, as shown in FIG. 1, the gas generator 60 made of the aluminum casing was assembled. The gas generator 60 contains the squib 10 having zirconium/potassium Perchlorate 120 milli-gram, the gas generant container 50 having the gas generant based on sodium azide 55 gram, and the igniting agents container 40 having the above mentioned spontaneous firing explosive composition. This gas generator 60 was used for test of a pressure-time with a 60-liter tank and a heating test with firewood (bonfire test). The results are given in Table 23 and Table 25. Differences in temperature histories during the 60 liter tank pressure-time test were slight. During the bonfire test, there were no differences in temperature histories found. An igniting time t (msec.) means a time up to start raising the pressure after an electrical current has finished flowing through the squib. Maximum pressure time means a time for pressure to become maximum. A heating time t means a time for the gas generator 60 to fire.

DEPR:

The spontaneous firing explosive composition 214 having function of automatic ignition is for example such a mixture of carbohydrate, oxohalogenates and metal oxides as proposed by Japanese Patent Application No. H 7-232613. The initiating agents 215 are for example zirconium/potassium perchlorate composition, zirconium/tungsten/potassium perchlorate composition, diazodinitrophenol and the like. The spontaneous firing explosive composition 214 having automatic ignition function can be contained in the squib without thermal influence by separately arranging the spontaneous firing explosive composition 214 having automatic ignition function and the initiating agents 215 having firing function. In more detail the first cup containing the spontaneous firing explosive composition 214 and the second cup containing the initiating agents 215 and blocked by the plug 213 are firstly manufactured. Then the second cup 212 with the plug 213 is inserted into the first cup 211, and they are assembled so that every end of the first cup 211, the second cup 212 and the plug 213 may meet at the same point C. The plug 213 is made of insulating material such as glass. Further the part C, where the first cup 211, the second cup 212 and the plug 213 are gathering, is melted by laser beam welding to realize fixing and sealing simultaneously.

CLPR:

14. The squib as claimed in claim 1, wherein said spontaneous firing explosive composition has thermal stability and comprises one of carbohydrates being selected from the group consisting of sucrose, lactose, glucose, powder cellulose, dextrin and wood powder, one of oxohalogenates being selected from the group consisting of chlorates, perchlorates, bromates, perbromates, iodates and periodates and one of metal oxides being selected from the group consisting of calcium oxide, magnesium oxide and zinc oxide.

CLPR:

15. The squib as claimed in claim 2, wherein said spontaneous firing explosive composition has thermal stability and comprises one of carbohydrates being selected from the group consisting of sucrose, lactose, glucose, powder cellulose, dextrin and wood powder, one of oxohalogenates being selected from the group consisting of chlorates, perchlorates, bromates, perbromates, iodates and periodates, one of metal oxides being selected from the group consisting of calcium oxide, magnesium oxide and zinc oxide and one of synthetic resins being selected from the group consisting of silicon resins, urethane resins, polyesters, acrylic resins and butyl rubbers.

CCOR:

102/202.6

CCXR:
102/202.5

CCXR:
102/202.7

WEST

Generate Collection

L11: Entry 8 of 19

File: USPT

Jun 13, 1995

DOCUMENT-IDENTIFIER: US 5423261 A

TITLE: Pyrotechnic trigger

DEPR:

- an oxidant (such as potassium perchlorate, potassium chlorate, or potassium nitrate),

DEPR:

- an additive to increase or decrease the power of the trigger (such as lead thiocyanate, aluminum powder, or lead dioxide).

CCOR:

102/202.14

CCXR:

102/202.2

CCXR:

102/202.5

CCXR:

102/202.9

WEST

Generate Collection

L11: Entry 10 of 19

File: USPT

Feb 16, 1993

DOCUMENT-IDENTIFIER: US 5187319 A

TITLE: Low vulnerability component of explosive ammunition and process for initiating a charge of low-sensitivity composite explosive

BSPR:

The composite explosive E is preferably a filled polyurethane plastic binder containing at least one explosive charge chosen from the group consisting of 5-oxo-3-nitro-1,2,4-triazole, triaminotrinitrobenzene, trinitroguanidine and mixtures thereof, and is preferably, 5-oxo-3-nitro-1,2-4-triazole. It may also contain other explosive charges, for example hexogen and/or octogen, and metal powder charges, for example, charge of aluminium and/or oxidising charges, for example ammonium perchlorate.

CCOR:

102/202.1

WEST

Generate Collection

L11: Entry 11 of 19

File: USPT

Jun 23, 1992

DOCUMENT-IDENTIFIER: US 5123355 A

TITLE: Rocket ignition assembly and means and methods for making and using same

DEPR:

A suitable rocket propellant for use herewith contains about 82 percent (w/w) of a suitable oxidizer such as ammonium perchlorate with or without aluminum powder and 18 percent of a synthetic rubber or hydroxy terminated polybutadiene, black powder, and like propellants.

DEPR:

In practice, the solution from which the pyrotechnic coating 17, 36 are formed will contain (w/w) from about 2 percent to about 50 percent carbon black, from about 0 percent to about 28 percent of carbon fiber, and a sufficient amount of an oxidizer/fuel mixture to total 100 weight percent. The oxidizer/fuel mixture contains ammonium or potassium perchlorate, metal powder and a binder selected from the group consisting of cellulose acetate, nitrocellulose, two-component epoxy, and urethanes. In a preferred practice, the solution will contain in weight percent about 14 percent milled PAN carbon fiber, (available from Fortafil Fibers Inc.) about 8 percent carbon black, and 78 percent of a mixture consisting of ammonium or potassium perchlorate, nitrocellulose and aluminum powder.

CLPR:

2. A rocket ignition assembly according to claim 1 in which said electrically conductive pyrotechnic coating consisting of a dried product of a homogeneous solution comprising of from about 2 percent to about 50 percent (w/w) carbon black, up to about 28 percent (w/w) carbon fiber, and a remainder consisting of an oxidizer, metal powder and a high-strength high-shrink binder uniformly dispersed therethrough.

CLPR:

12. A rocket ignition assembly according to claim 11 in which said electrically conductive pyrotechnic coating consists of a dried product of a homogeneous solution consisting of from about 2 percent to about 50 percent carbon black, up to 28 percent carbon fiber, and a remainder consisting of an oxidizer, a metal powder and a high-strength high-shrink binder uniformly dispersed therethrough.

CCXR:

102/202.11

CCXR:

102/202.9

WEST

Generate Collection

L11: Entry 12 of 19

File: USPT

Feb 18, 1992

DOCUMENT-IDENTIFIER: US 5088412 A

TITLE: Electrically-initiated time-delay gas generator cartridge for missiles

DEPR:

The space between Mylar disc 39 and the forward face of glass 31 contains ignition powder 41. The ignition powder 41 may be an of numerous ignition systems known in the art with the appropriate ignition sensitivity, heat generating characteristics, and storage properties. An oxidant/fuel pair consisting of boron/calcium chromate is particularly suitable. However, mixtures of magnesium, aluminum, titanium, or zirconium with oxidants such as ammonium or potassium perchlorate, barium or potassium nitrate, barium or lead chromate, or cupric or lead oxides may be formulated to meet the ignition requirements of this device.

DEPR:

Accordingly, the function time may be altered by varying any of the determining parameters within the limits of the available volume. For applications which do not require function time tolerances of less than 25 msec, the powder mixtures and packing densities are less critical than they are relative to more demanding tolerance requirements. For example, tungsten powders combined with oxidants such as barium chromate and potassium perchlorate with a diatomaceous earth binder will burn reliably with the desired caloric energy, and with meticulously uniform packing densities and column packing heights, function time tolerances of somewhat less than 25 msec can be achieved. However, the tungsten fuel systems are better suited for less demanding applications. Additionally, such fuel systems are somewhat sensitive to moisture and will lose activity with long term storage.

CLPV:

(e) a delay column comprising a plurality of layers of delay powder provided in said passage between said igniter assembly and said barrier disc, said plurality of layers in said delay column comprising a combination of zirconium metal powder, red iron dioxide powder, and diatomaceous earth binder powder, said layers being compressed in place in said passage at pressures sufficiently high to provide function time tolerances of less than 25 msec, the outer one of said layers being packed against said barrier disc,

CLPV:

(e) a delay column comprising a plurality of layers of delay powder provided in said passage between said igniter assembly and said barrier disc, said layers of delay powder comprising a combination of zirconium metal powder, red iron oxide powder, and diatomaceous earth binder powder and said layers being compressed in place in said passage at a high compression pressure of about 30,000 psi, the outer one of said layers being packed against said barrier disc,

CCOR:

102/202.13

CCXR:

102/202.5

WEST

Generate Collection

L11: Entry 13 of 19

File: USPT

Jul 2, 1991

DOCUMENT-IDENTIFIER: US 5027707 A

TITLE: Electric primer with reduced RF and ESD hazard

BSPR:

The second type of electric primer involves the use of an explosive primer mixture having a conductive substance such as noble metal filings, metal powder, or some form of carbon such as carbon black mixed therein to provide many small conduction paths. Like the bridge wire primer, a sufficient current passing through the conducting powder causes localized heating and/or a spark which in turn detonates the explosive primer mixture.

BSPR:

In contrast, the prior art conductive mixture type electric primers provide an enormous number of redundant electrically conductive paths and thus theoretically may be much more reliable. Electric primers utilizing a conductive mixture composition generally include an explosive component and a finely divided noble metal powder or carbon black. One such device is disclosed in U.S. Pat. No. 3,090,310 issued to Peet et al. The conductive mixture in Peet et al comprises zirconium, zirconium hydride, barium nitrate, lead peroxide, and pentaerythritol tetranitrate (PETN). This is an explosive primer mixture having a substantial percentage of PETN, approximately 20%. This mixture requires a substantial input of energy for detonation and is designed for use in rapid fire guns requiring a high firing voltage to preclude premature firing.

BSPR:

Other examples of electric primers utilizing conductive mixtures are those described in U.S. Pat. Nos. 3,793,920, 3,320,164, and 3,155,553. These patents each disclose a composition having a finely divided detonating material such as lead azide or other explosive and either carbon in some form or a finely divided noble metal powder. These metals and/or carbon act as conductors and do not act primarily as a fuel and therefore their content is minimized in order to achieve the desired results.

BSPR:

A conductive mixture without an explosive, utilized in an electric primer, is disclosed in U.S. Pat. No. 4,070,970 issued to Scamaton. This patent discloses an electric ignitor having good resistance to low voltage accidental triggering. The mixture disclosed in this patent is a mixture of copper oxide and aluminum powder. This is a thermite mixture having a pre-breakdown DC resistance of at least 1 megohm. The mixture requires a relatively high initiation voltage and relies upon breakdown of the dielectric material presented by copper oxide. In fact, this mixture requires a voltage of approximately 1700 volts applied to achieve dielectric breakdown and ignition. Accordingly, this mixture is not useful at low voltages.

BSPR:

Another primer mixture is disclosed in U.S. Pat. No. 4,522,665 issued to Yates et al. The primer mixture disclosed in the Yates Patent is a percussive priming mixture whose composition is similar to that of the present invention as will be subsequently described. However, this patent teaches use of a mixture of titanium and potassium perchlorate not in an electric primer application, but in a percussive primer where a substantial level of impact energy is required for ignition. The Yates Patent does not teach the use of titanium and potassium perchlorate in electric primer applications at low voltages. In fact, this patent specifically teaches that this mixture would require the use of a separate heating element for electric ignition as in bridge wire primers.

BSPR:

The electric primer includes a cup shaped outer electrode having a central bore through the bottom of the cup and an inner button shaped electrode disposed within the cup and spaced from the outer electrode. The inner electrode has a terminal portion extending through the bore, out of the outer electrode for connection to an external electrical power source, typically the vehicle battery. An insulator sleeve is placed between the button portion of the inner electrode and the outer electrode thus spacing and separating the electrodes from one another. A pyrotechnic mixture of a metal powder fuel, an alkaline oxidizer, and a sensitizing fuel are compacted together, preferably at a pressure of at least 3000 psi, within the cup. A thin layer of carbon is disposed between the mixture and the electrodes. This layer of carbon communicates between the inner and outer electrodes over the end surface of the insulator.

BSPR:

The metal fuel may range between 15% and 50% dry weight with the oxidizer between 75% and 40% dry weight, with the remainder being made up of one or more sensitizer fuels such as boron or lead thiocyanate. Preferably, the pyrotechnic mixture consists of essentially titanium metal powder in about 27% dry weight, potassium chlorate in about 68% dry weight, and 5% dry weight of boron as a secondary fuel sensitizer.

DEPR:

The intrinsic conductive pyrotechnic mixture 26 consists essentially of about 15% to 50% dry weight of a finely divided metal powder fuel, about 75% to 40% dry weight of an alkaline oxidizer, and about 2% to 15% dry weight of at least one secondary sensitizing fuel mixed together. The mixture 26 may also include a binder to hold the mixture together in certain applications.

DEPR:

The metal fuel in the mixture may be any oxidizable metal powder which can serve as the primary fuel and provide a conductive path for electrical current through the mixture. More specifically, the metal powder fuel is preferably selected from the group consisting essentially of titanium, zirconium, uranium, and aluminum. A specifically preferable metal powder fuel for use in the mixture 26 for application in automotive airbag inflator electric primers is titanium.

DEPR:

The alkaline oxidizer advantageously utilized in the mixture 26 may be an alkaline oxidizer selected from the group consisting essentially of an alkali metal or an alkaline earth metal chlorate or perchlorate. Both chlorates and perchlorates must be used with care as they are very reactive and verge on being an explosive themselves. Illustrative examples in this group include potassium, sodium, and calcium chlorate. More specifically, a preferred oxidizer for use in the mixture 26 for automotive airbag inflator primers is potassium chlorate.

DEPR:

The mixture is preferably formulated with 20%-45% dry weight titanium metal powder, 75%-40% dry weight potassium chlorate, and 2%-15% dry weight secondary fuel sensitizer. In addition, a binder material of 1%-3% dry weight may be added. Finally, an additional fuel sensitizer may be utilized such as lead thiocyanate to further adjust the sensitivity and firing threshold of the mix for a particular design and for a given operating temperature range.

DEPR:

One exemplary preferred embodiment of the mixture comprises 27% dry weight titanium metal powder, 68% dry weight potassium chlorate, and 5% dry weight boron. This composition, compacted to about 3000 psi within cup 12 ignites readily when a voltage of 9-12 volts is applied to the electrodes 12 and 16 via the power supply 22. The resistance of the primer according to the present invention using this mixture composition is about 2 ohms.

CCOR:

102/202.8

CCXR:

102/202.9

WEST

Generate Collection

L11: Entry 17 of 19

File: USPT

Dec 27, 1983

DOCUMENT-IDENTIFIER: US 4422381 A

TITLE: Igniter with static discharge element and ferrite sleeve

BSPR:

Numerous patents illustrate EED's containing a static discharge element in the form of a semiconductive plug, or "static shunt mix," consisting of metal powder such as alumina dispersed in a nonconductive binder such as wax or polyethylene. Such EED's are shown for example in U.S. Pat. Nos. 2,658,451 to Horne, 2,802,421 to Horne et al., and 3,194,160 to Spillane et al. A semiconductive plug presents a conductive discharge path for high voltage discharges and a high resistance path for the low voltages normally used to fire EED's. Disadvantages of semiconductive mixes are twofold. First of all, dielectric strength and insulation resistance are relatively low and variable. The second disadvantage is that the static discharge mix is of paste consistency and must be introduced into the EED in precise amounts, which is difficult and expensive because of the small sizes of most EED's.

DEPR:

A base charge 14 of powdered igniter material, preferably a titanium/potassium perchlorate mixture, is located inside casing 12 adjacent the closed end thereof. Next to the base charge 14 is a heat ignitable charge 16 and charge holder 18 therefor. The heat ignitable charge 16 is preferably pressed barium styphnate but may be another heat ignitable material which in combustion liberates enough heat to ignite the base charge 14. The charge holder 18 is an annular plastic member, preferably made of glass-filled nylon. The central opening of charge holder 18 contains the ignition charge 16, and the outer wall abuts the casing 12. Charge holder 18 has a shoulder 18a.

DEPR:

The present invention will now be described with reference to a specific embodiment thereof. This specific embodiment is constructed in accordance with the drawings herein, having a length not exceeding 1.1 inch (2.8 cm) and having a diameter of 0.3 inch (0.76 cm). The base charge consists of 90 mg of titanium/potassium perchlorate mixture pressed at 5,000 psig. The ignition charge consists of 9 mg. of barium styphnate, having a moisture content not over 0.5%, which is pressed at 25,000 psig. Lead wires 22a, 24a and 0.04 inch (0.1 cm) in diameter. The static discharge disc is 0.26 inch in diameter, 0.032 inch thick (including the copper layers on either side, each of which is about 0.0004 inch thick), with a slot width of 0.042 inch and a copper-free substrate width of 0.051 inch.

CCOR:

102/202.2

CCXR:

102/202.12

CCXR:

102/202.14

CCXR:

102/202.4

CCXR:

102/202.5

CCXR:

CCXR:

102/202.8

WEST**End of Result Set****Generate Collection**

L11: Entry 19 of 19

File: USPT

Feb 26, 1980

DOCUMENT-IDENTIFIER: US 4190413 A

TITLE: Photoflash lamp

BSPR:

U.S. Pat. No. 4,059,388 of John W. Shaffer, describes a primer material comprising a mixture of combustible metal powder (zirconium), an additive of one of more metal oxides which are electrically non-conductive but combustion-supporting, such as WO.sub.3, and a binding agent, but which is free of oxidizer salts. The metal oxides function as an oxygen donor and do increase the breakdown voltage somewhat. The elevation of breakdown voltage attainable through such oxide addition alone, however, is insufficient to give lamp populations essentially free of lamps with less than a 200-volt minimum.

BSPR:

Another U.S. Pat. No. 3,972,673 of Schupp, describes a primer material which comprises a solid mixture of combustible fuel, an oxidizer for the fuel, such as an alkali metal chlorate or perchlorate, and a combustion supporting oxide of the type which is converted to a lower oxide upon combustion of the mixture. More particularly, the Schupp patent indicates that certain metal oxide additives in this solid primer mixture promote a more complete combustion of the primer fuel. It is hypothesized that the additive is partially reduced through chemical reaction taking place when the lamp is flashed to provide a source of oxygen which is readily available for combustion of the primer fuel by reason of the oxygen being generated in the solid mixture. The specific combustion-supporting oxides indicated as suitable for this application comprise Co.sub.3 O.sub.4, BaCrO.sub.4, Fe.sub.2 O.sub.3, and the higher oxides of nickel. A preferred primer material composition is given as comprising a solid mixture, in percentages by weight, of 46.1 percent zirconium, 14.5 percent sodium chlorate, 31.7 percent Co.sub.3 O.sub.4, and 7.7 percent BaCrO.sub.4, and further containing between 1-5 percent of water soluble polymer binder such as polyvinyl alcohol or polyvinyl pyrrolindone. These materials are dispersed in water to provide a wet paste for manufacturing use.

BSPR:

It is to be noted that the present additive comprises relatively large solid particles, whereas the previously mentioned alumina gel consists of porous gel structure of very fine ultimate particle size. Further, the comparatively large proportion of additive employed reduces the criticality of the amount of additive in the mixture and, thereby, results in an improved primer mixture which is more compatible with automated production processes than the previously referenced alumina gel additive. The large proportion of additive with a coarse solid particle size yields an additional benefit which results from the lowered average quantity of combustible metal powder (fuel) used per lamp. Such particle diluted primers results in a freeing of gaseous oxygen for reaction with the shredded combustible in the lamp. This benefit is primarily realized with the safe primers which are free of oxidizer salts.

DEPR:

In accordance with the present invention, we have discovered that a reliable primer with an enhanced breakdown voltage can be provided by the use of an additive of relatively coarse inert particulate material which is insoluble and non-conductive and has a particle size substantially larger than that of the combustible powdered fuel. For example, primer material 16 may be provided by mixing a particulate fuel, typically a combustible metal powder such as zirconium, with a larger percentage of the inert additive, and a binding agent

such as nitrocellulose in a suitable solvent, for example, methyl cellosolve. The resultant primer mixture is then applied, such as by a dip process. For example, after press sealing the lead-in wires into the lamp and prior to filling with shreds and oxygen, the end portions of the frit coated lead-in wires are dipped into a primer cup which passes through the open end of the glass tubing, so as to apply the coating 16 of the primer material about the wire terminations, as shown in FIGS. 1 and 2. When dried, the primer shows substantially increased ignition sensitivity for high voltage discharge therethrough.

DEPR:

Alternatively, a thermite-type primer, such as described in U.S. Pat. No. 4,059,388, may be employed. In this instance, the above noted primer mixture further includes one or more metal oxides from the group of metals comprising cobalt, tungsten, manganese, nickel and/or copper. The proportion of metal oxides can be from about 1 to 130 percent of the stoichiometric quantity required for chemical reaction with the combined metal fuels in the mixture. That is, the amount of metal oxide used should fall within plus 30 percent or minus 99 percent of the calculated stoichiometric quantity required for thermite-type reaction with all the metal powder used. This thermite-type reaction composition increases the breakdown voltage of the primer as compared to oxidizer free primers so as to preclude inadvertent simultaneous flashing of array lamps due to high voltage leakage paths in the interconnecting structure of the circuitry. The fuel portion of the mixture may also include magnesium powder as an additive to lower the electrical breakdown voltage where some degree of adjustment to the electrical voltage sensitivity of the primer is desired. For example, magnesium powder content may be from 0 to 30 percent by weight on a dried basis.

DEPR:

Yet a further alternative, although not as desirable, comprises the use of an oxidizer, such as sodium chlorate or potassium chlorate, along with the mixture of combustible metal powder, inert additive, and binder.

DEPR:

Alternative methods would include the obvious substitution of particulate nonconducting material in other than bead shaped particles. While it is felt that microbeads give more predictable void volume and geometry, and thereby greater freedom from performance idiosyncracies due to lot-to-lot variations, this invention is not intended to be limited solely thereto. The composition of the particulate additive may encompass a variety of materials. Glasses, silica, refractory oxides, and other such materials which are insoluble in the vehicle used, could be substituted. The mean particle size is preferably significantly greater than that of the zirconium (or other combustible metal) powder used. Numerically, the inert particle diameter or mean dimension should average from 10 to 50 times that of the metal powder. In the example cited, the glass microbeads were of 30 microns average diameter and the zirconium powder was about 1.2 microns size. The weight percentage of the inert nonconducting particulate additive may be from 10 to 60 percent on a dried basis. The optimum value is expected to vary with the particle size and shape chosen; for the glass microspheres cited, the optimum content is about 30 percent as shown.

CLPR:

3. The lamp of claim 1 wherein said fuel is a combustible metal powder.

CCXR:

102/202.5